

## Chapter

# 4

## Managing the Information System Infrastructure

*Based on results of survey data from 2004, 70% of respondents had stolen key information from an employer*

**Ibas - Data forensics firm, UK**

# Learning Objectives

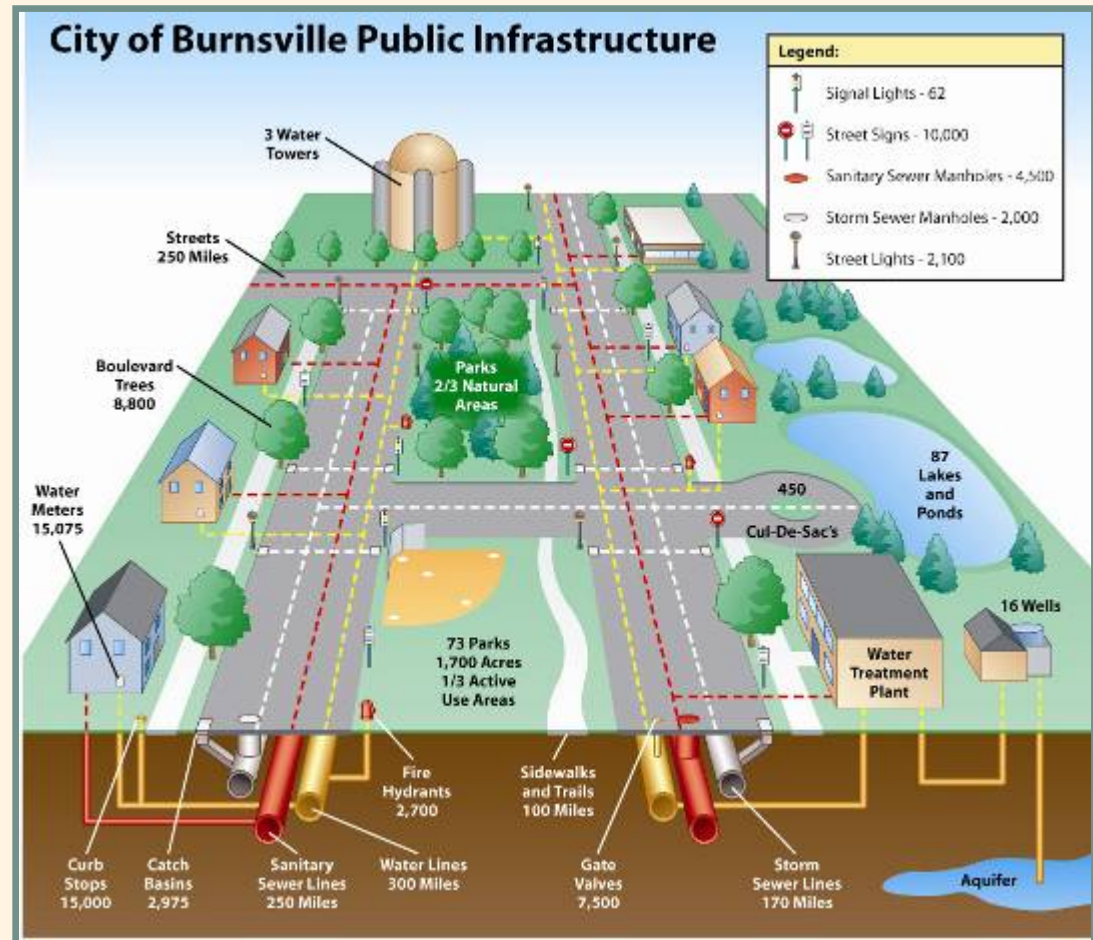
- 1 List the essential information systems infrastructure components and describe why they are necessary for satisfying an organization's informational needs.
- 2 Describe solutions organizations use to design a reliable, robust, and secure infrastructure.
- 3 Describe how organizations can ensure a reliable and secure infrastructure, plan for potential disasters, and establish IS controls.

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# Infrastructure

- Interconnection of basic facilities and services enabling the area to function properly



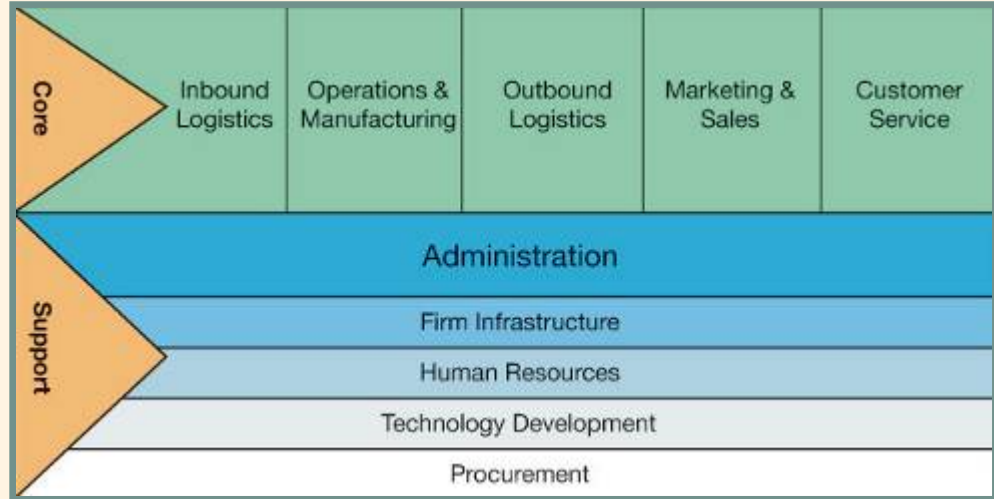
# The IS Infrastructure

- Google's newest data center – The Dalles, OR
- Why there?
  - Fiber-optic network connectivity
  - Access to water for cooling needs
  - Cheap, uninterrupted power from a nearby hydroelectric dam



# The Need for an IS Infrastructure

- Businesses rely on IS infrastructure to support business processes, decision making and competitive strategy
- **Business Processes**
  - Activities that organizations perform to achieve business goals
    - Core Processes
    - Supporting Processes





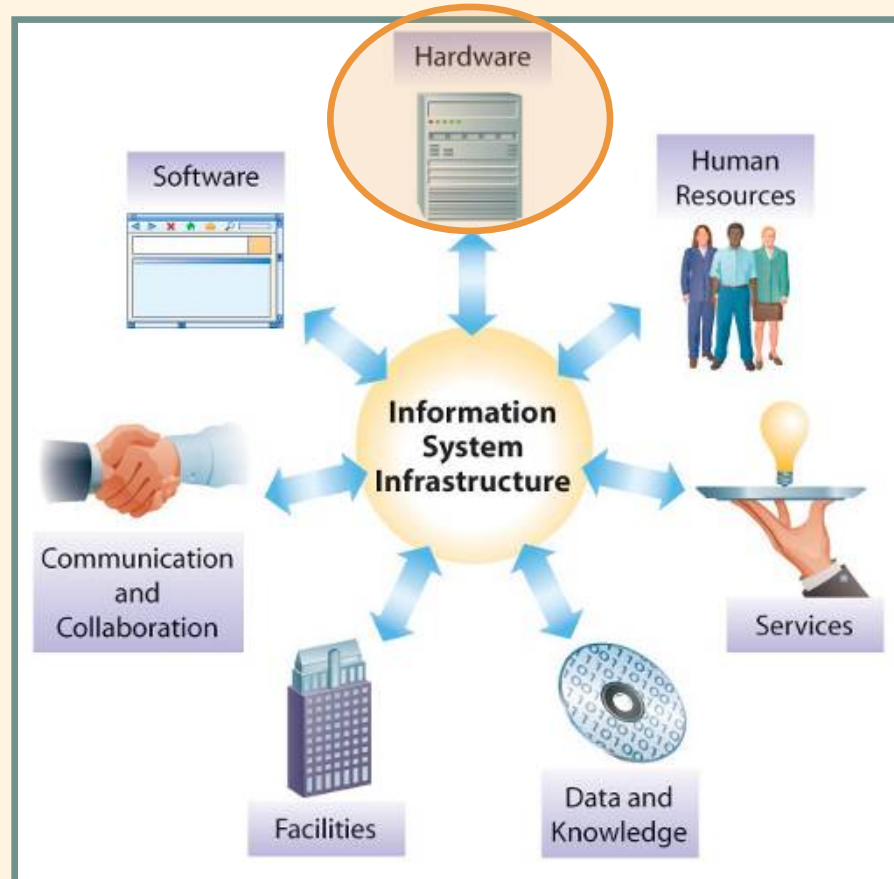
# IS Infrastructure

- IS infrastructure components include:
  1. Hardware
  2. Software
  3. Networks
  4. Data
  5. Facilities
  6. Human resources
  7. Services



# IS Infrastructure: Hardware

- Integral part of the infrastructure:
  - Computers
  - Networking hardware





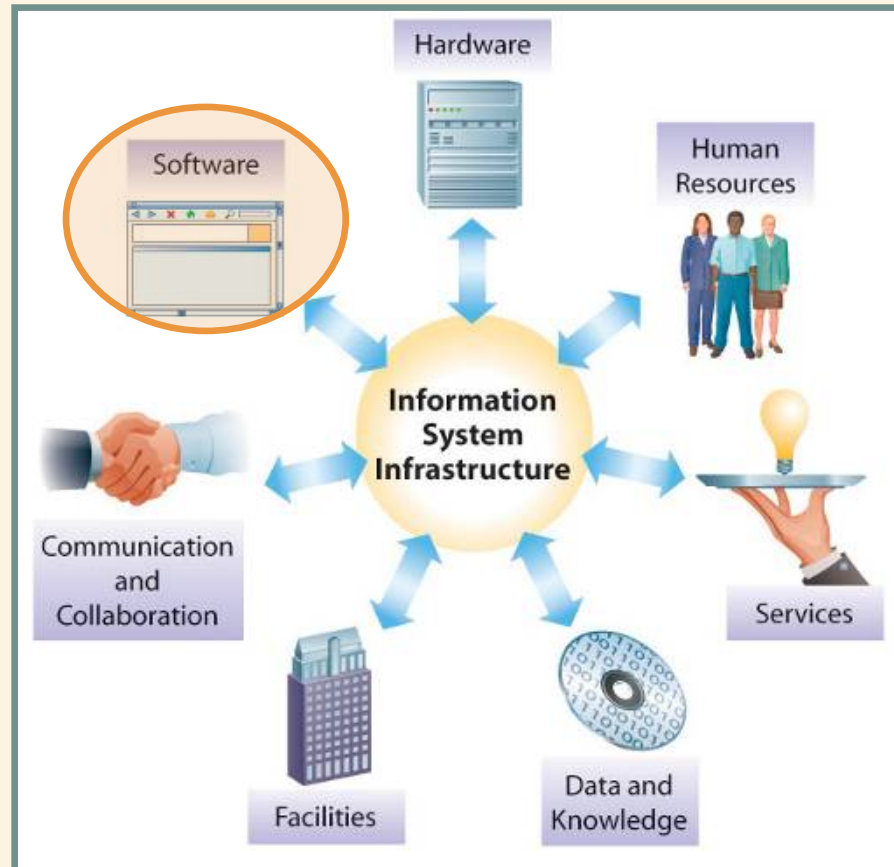
# IS Infrastructure: Hardware (II)

- Issues:
  - What technologies to choose
  - When to replace equipment
  - How to secure infrastructure
  - How to assure reliability
  - Etc.



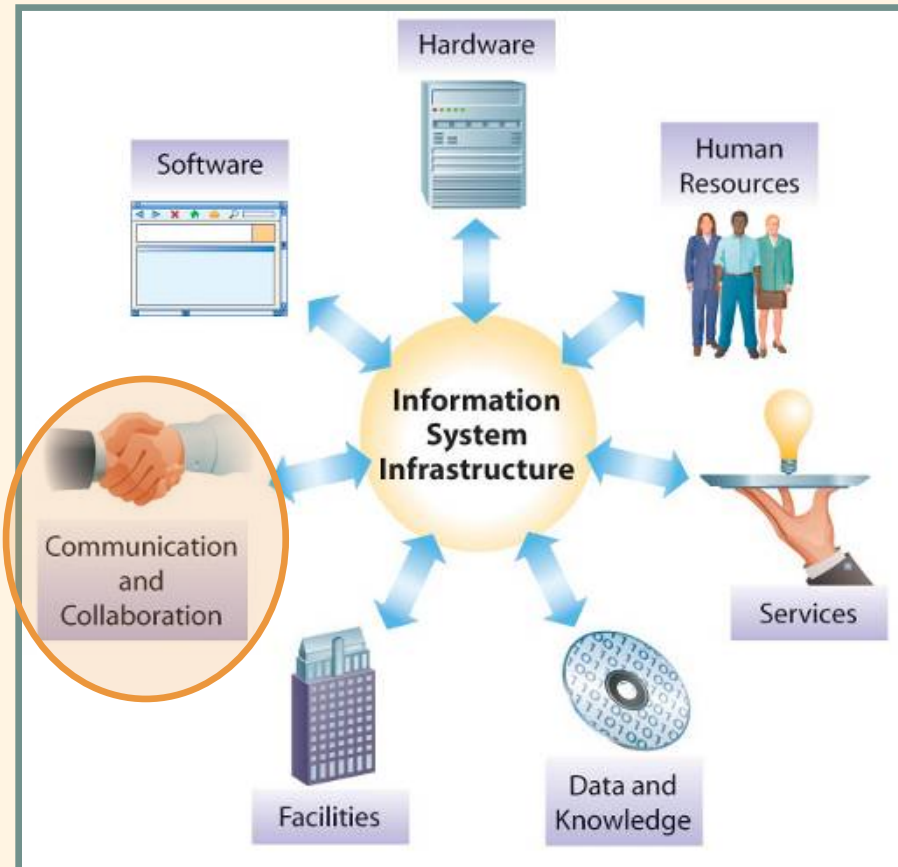
# IS Infrastructure: Software

- Software enables companies to utilize their IS hardware
- Issues:
  - Updates
  - Fixing bugs
  - Software licenses
  - Etc.



# IS Infrastructure: Communication and Collaboration

- Help organizations to become powerful
- Enabled by networking hard- and software
- Also
  - Email servers
  - Communication software
  - Etc.



# IS Infrastructure: Communication and Collaboration (II)

- Key issue
  - What types of communication technologies support the organization's goals?



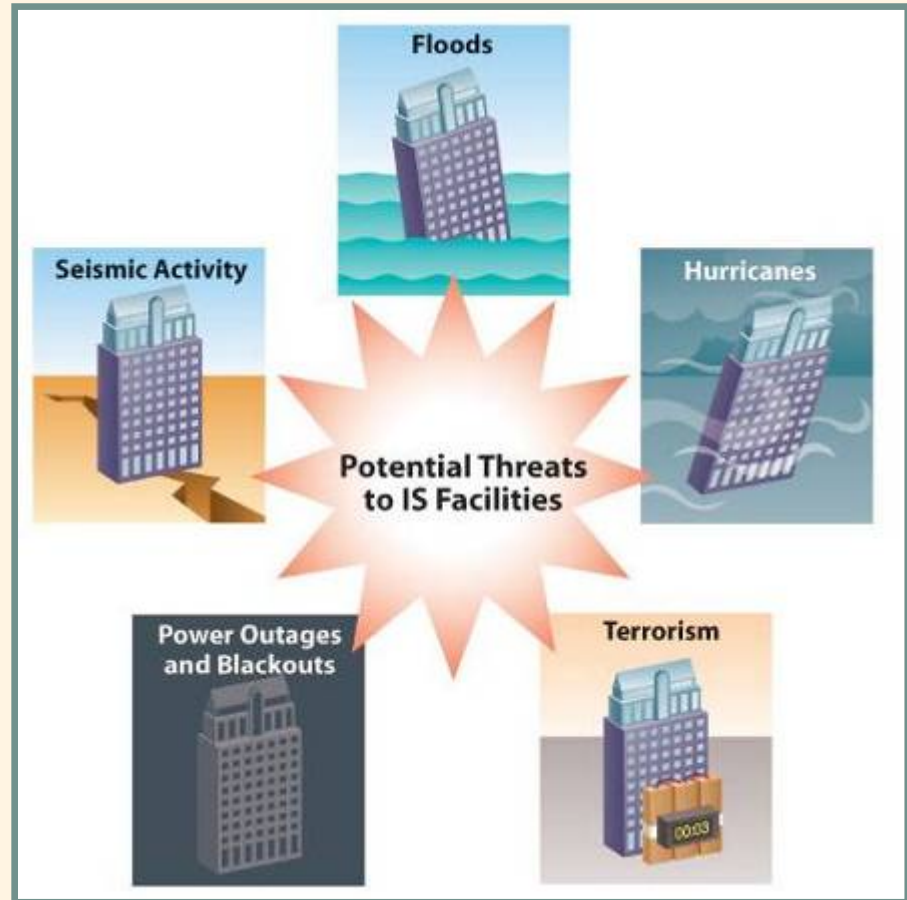
# IS Infrastructure: Facilities

- Need for specialized facilities, including:
  - Electricity
  - Cooling
  - Etc.



# Potential Threats to IS Facilities

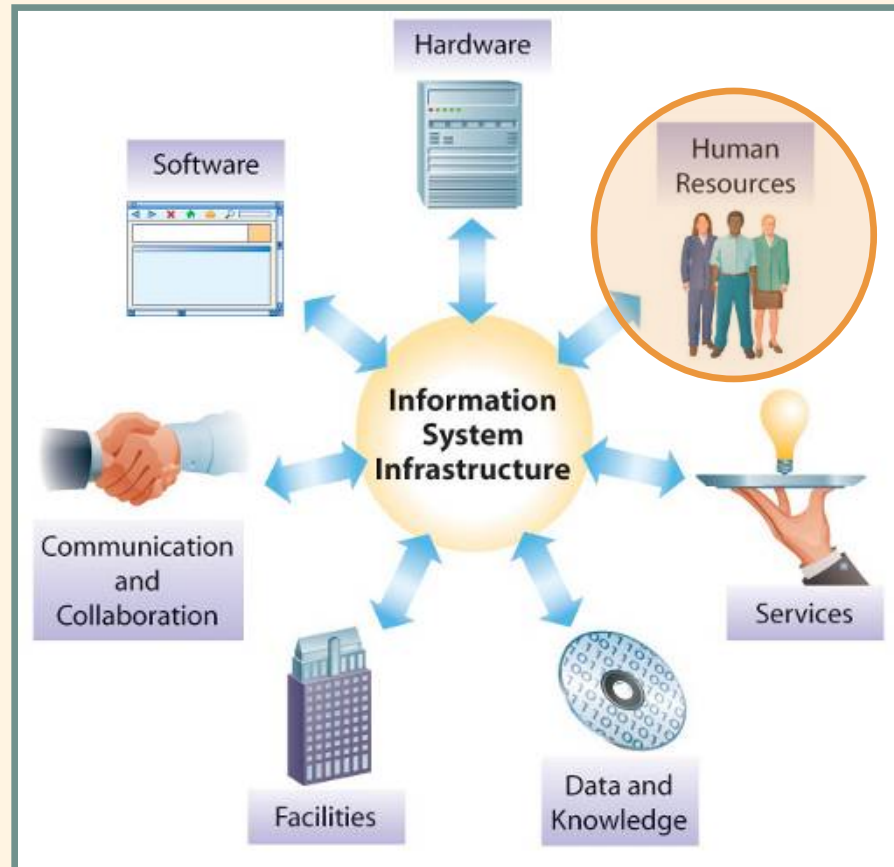
- Key issues:
  - Where to house data centers, etc.
  - Threats to IS facilities
    - Outside intruders
    - Environmental elements





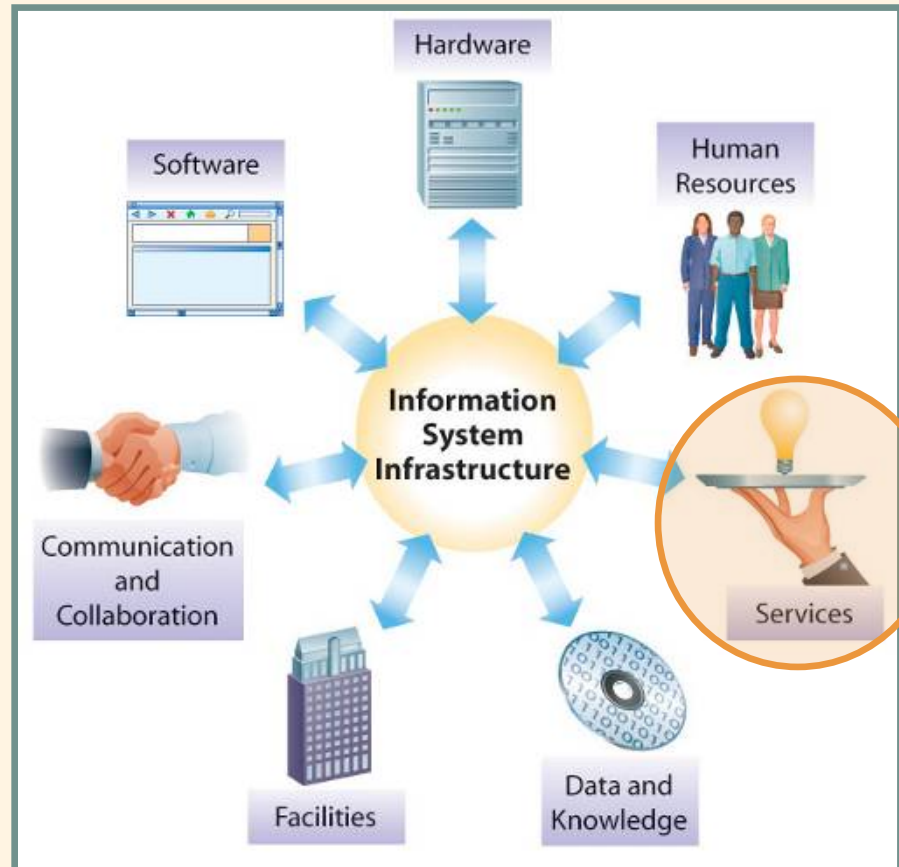
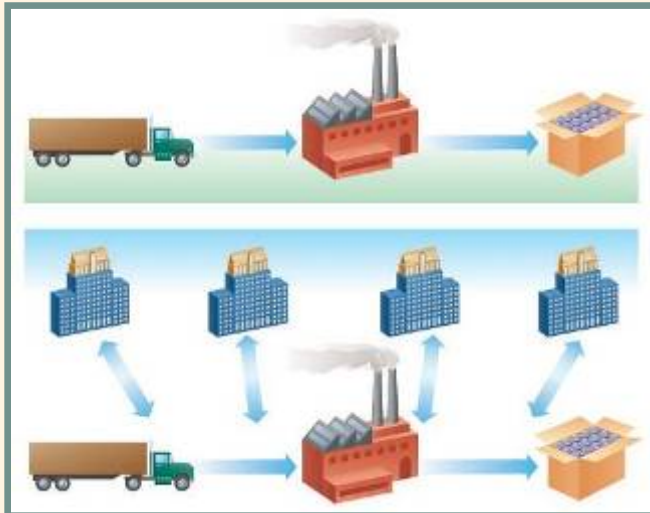
# IS Infrastructure: Human Resources

- Need for trained workforce
  - Influences location decision



# IS Infrastructure: Services

- Processes which are not core competencies are often delegated to companies with more experience

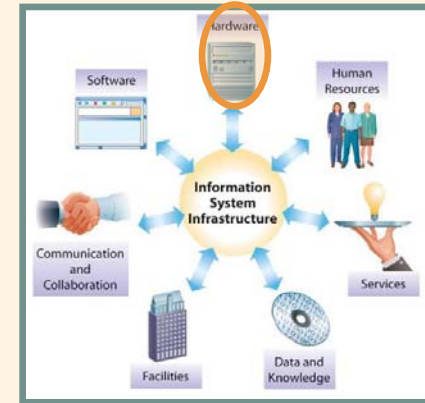


# Learning Objectives

- 1 List the essential information systems infrastructure components and describe why they are necessary for satisfying an organization's informational needs.
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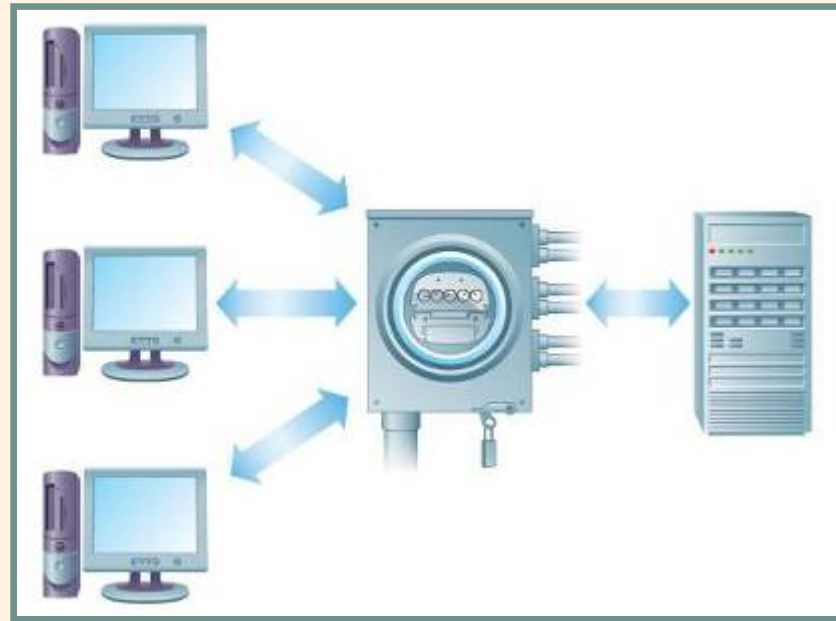
# Managing the Hardware Infrastructure

- Issues to consider:
  - Fluctuating computing demand
  - Large-scale problems
  - System complexity



# Fluctuating Computing Demand

- **On-demand computing**
  - Available resources allocated based on user needs
  - Utility computing
    - On-demand computing rented from external provider
    - Paid on as-needed basis



# Solving Large-Scale Problems

## ● **Grid Computing**

- Combines computing power of a large number of smaller, independent, networked computers
  - Tasks broken down into smaller chunks
- Dedicated vs. heterogeneous grids
  - Acquisition vs. management costs
- Edge computing
  - Save bandwidth
  - Improved Response time





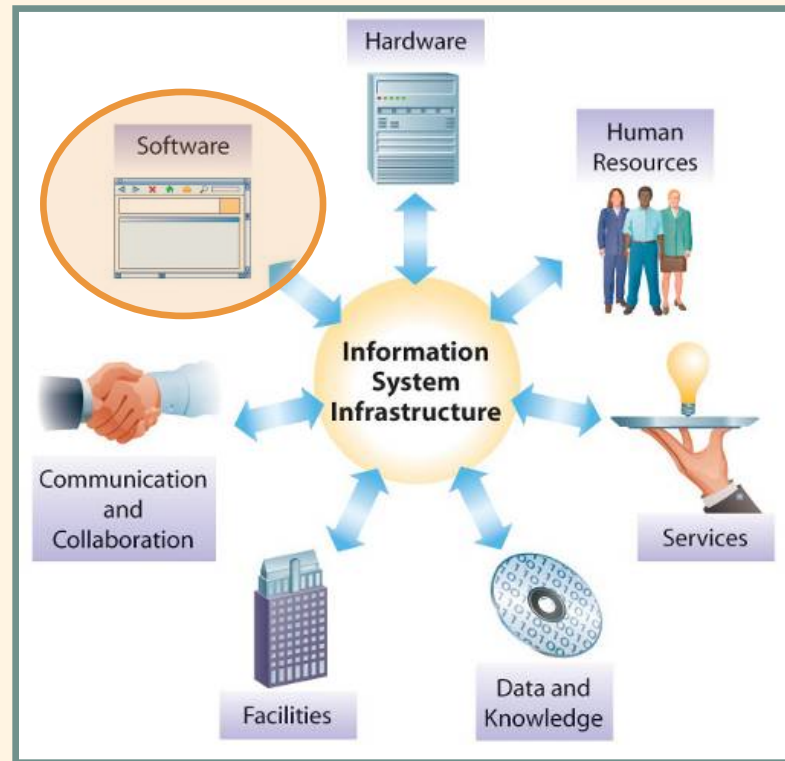
# Managing System Complexity

- Autonomic computing
  - Self-managing systems requiring minimal human intervention to operate



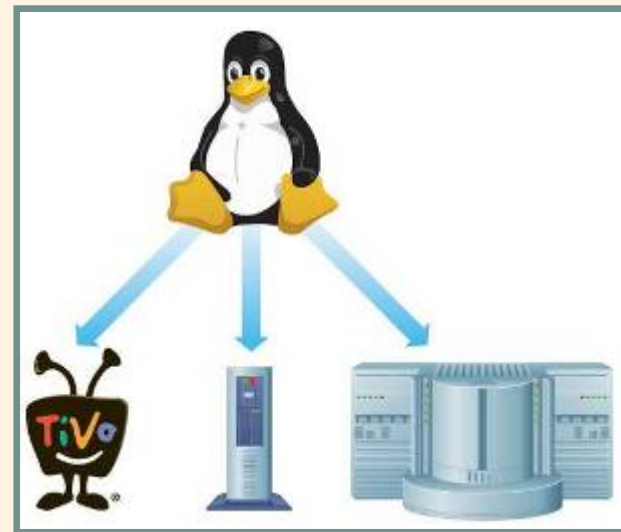
# Managing the Software Infrastructure

- Primary issues to consider:
  - Cost of software
  - Integration
  - Managing bugs and licenses
  - Fluctuating computing needs



# Open-Source Software

- Open-source movement aided by the advent of the Internet
- Source code is freely available for use and/or modification
  - Open-source operating system
    - Linux
      - Used in everything from fridges to personal computers to supercomputers



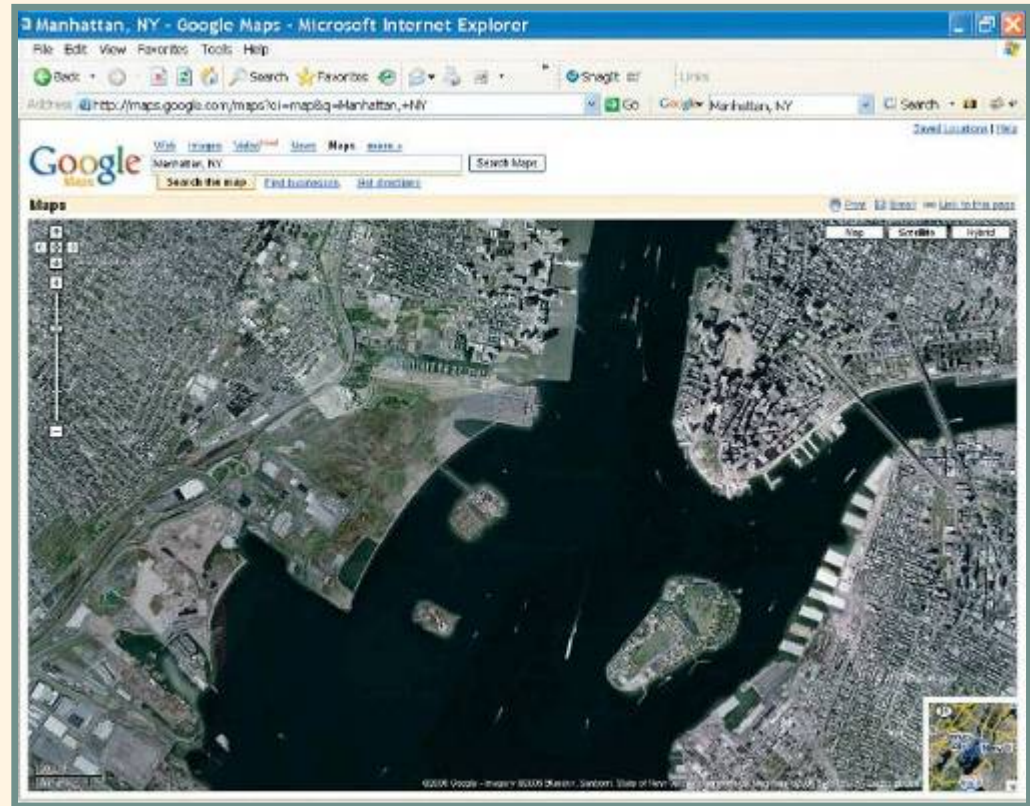
# Open-Source Application Software

- Open-source application software
  - Apache Web server
  - Firefox Web browser
  - OpenOffice
- Drawback:
  - Finding customer support may be difficult



# Web Services

- Web-based software systems allowing for an interaction of different programs and databases over a network
- Service-oriented architecture



# Managing Software Assets

- **Managing software bugs**
  - Increased complexity of applications prevents error-free development
  - Patch management system
- **Managing software licensing**
  - Hot topic due to problems with piracy
  - Shrink-wrap license
  - Enterprise license
  - Software asset management



# Application Service Providers

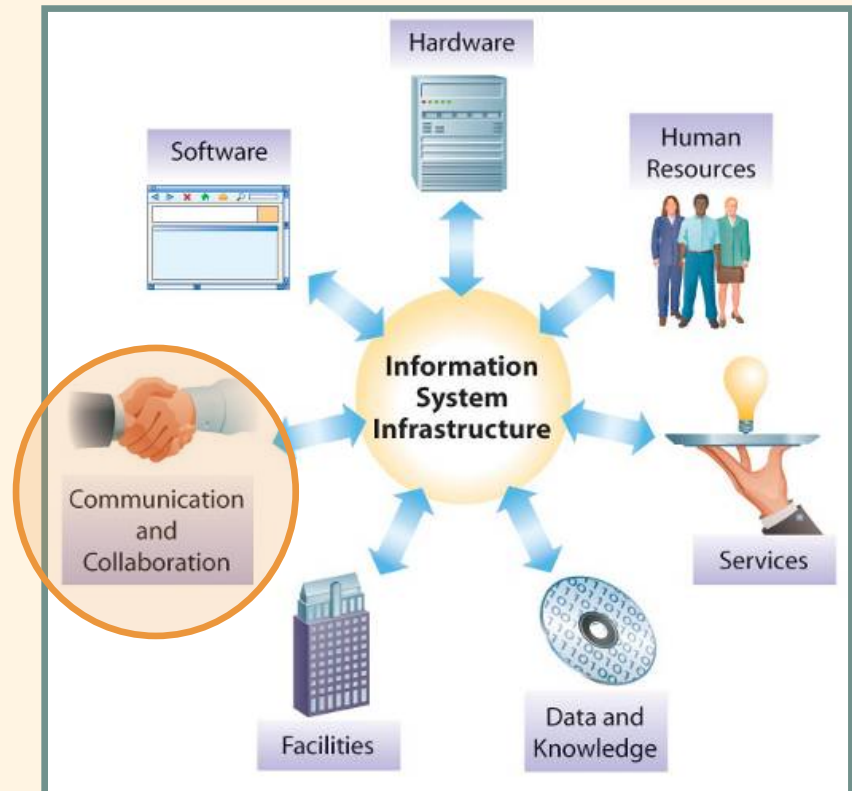
- ASPs provide on-demand software access over the Web
  - Specific software located on the ASP's server
  - Accessed using Web-enabled interfaces
- Benefits:
  - Reduced need to maintain or upgrade software
  - Fixed monthly fee for services
  - Reliability
- Example: Google Calendar

# Application Service Providers (II)

- Types of ASPs:
  - Specialist or functional ASP
  - Vertical market ASP
  - Enterprise ASP
  - Local ASP

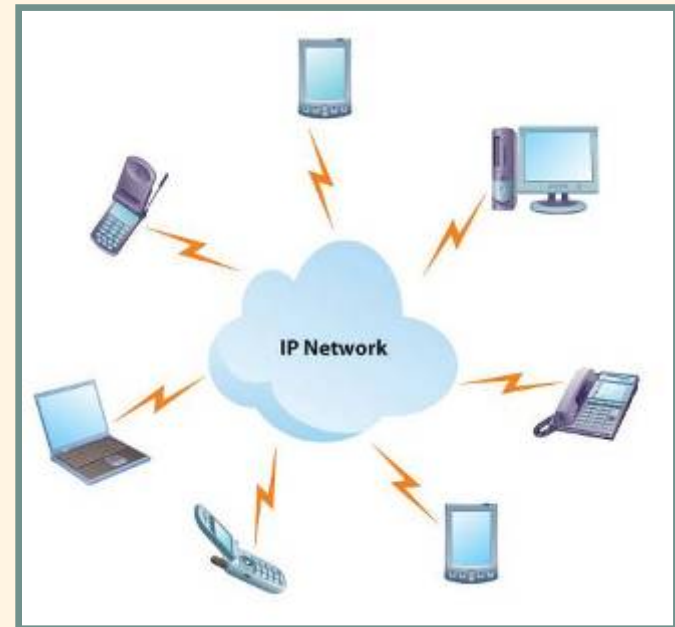
# Managing the Communication and Collaboration Infrastructure

- Diverse communication needs
- Solution:
  - Convergence
  - Increasing mobility



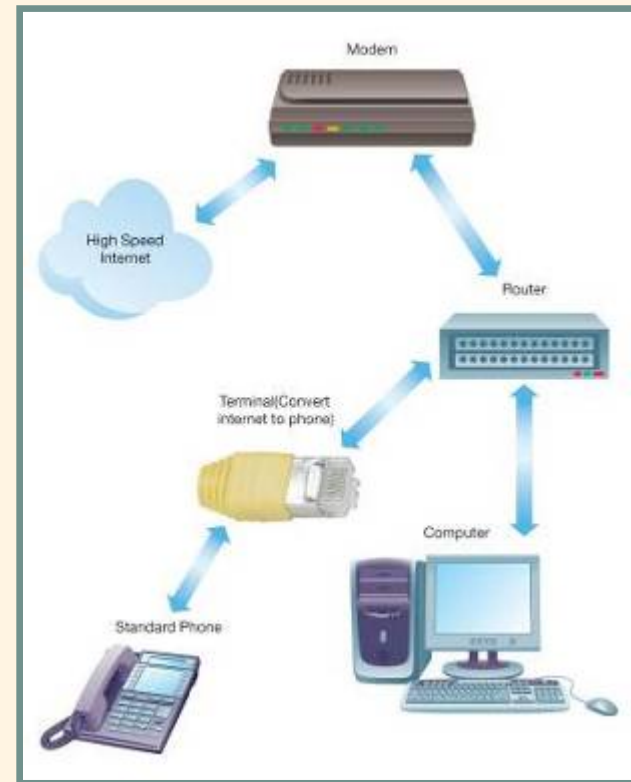
# Convergence of Computing and Telecommunication

- Convergence of functionality of devices
  - Cell phone and PDA
- Convergence within underlying infrastructures
  - IP convergence
    - Voice over IP
    - Videoconferencing over IP



# IP Convergence: VoIP

- Use of Internet technologies for placing telephone calls
  - High quality of transmission possible
  - Ability to call from any place with Internet connection



# IP Convergence: Videoconferencing over IP

- IP used to transmit video data
  - Desktop video conferencing
  - HP Halo meeting room: \$400,000





# Increasing Mobility

- Knowledge workers require access to information from anywhere
  - Communication devices
  - Wireless devices capable of connecting to organization's internal network
- Wireless security concerns



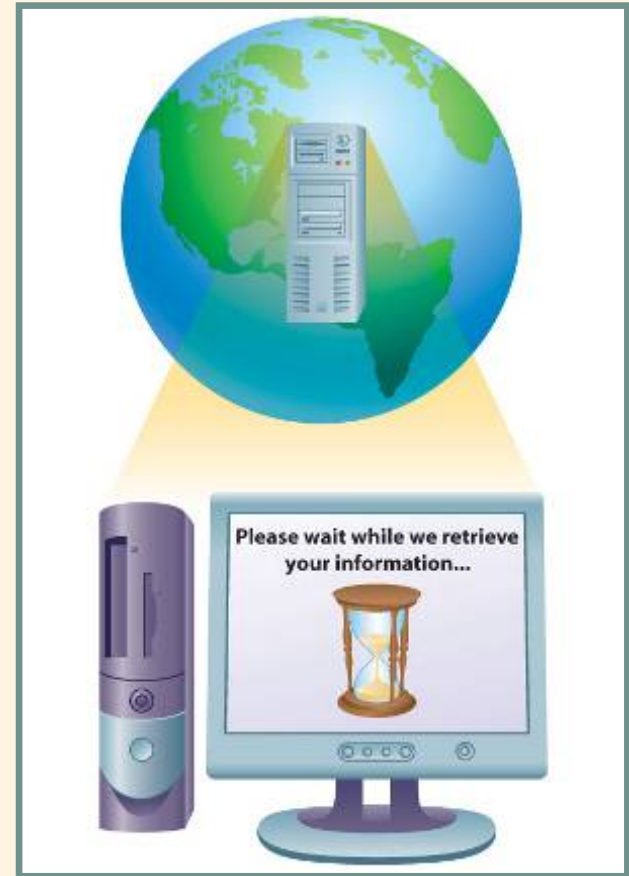
# Managing the Data and Knowledge Infrastructure

- Organizations need to find new ways to manage:
  - Data from different sources
    - Data mining
  - Internal knowledge
    - Knowledge management tools



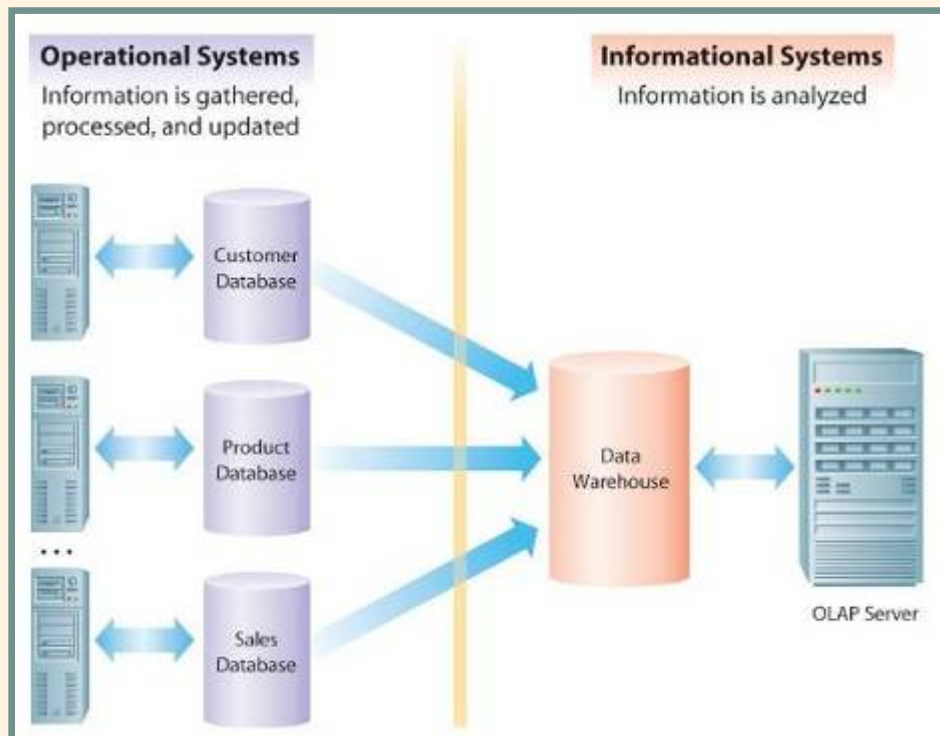
# Data Mining

- Online transaction processing (OLTP)
  - Immediate response to user requests
- Online analytical processing (OLAP)
  - Quickly conducting complex analyses on data stored in a database



# Data Mining

- Enhancing business intelligence by combining data from various sources



# Operational vs. Informational Systems

Characteristic	Operational System	Informational System
Primary purpose	Run the business on a current basis	Support managerial decision making
Type of data	Current representation of state of the business	Historical or point-in-time (snapshot)
Primary users	Online customers, clerks, salespersons, administrators	Managers, business analysts, customers (checking status, history)
Scope of usage	Narrow and simple updates and queries	Broad and complex queries and analyses
Design goal	Performance	Ease of access and use

# Data Warehouses and Data Marts

- Data Warehouse

- Integration of multiple large databases and other information sources into a single repository
- Pull together, integrate, and share critical corporate data throughout the firm

- Data Mart

- Data warehouse that is limited in scope
- Customized for the decision support applications of a particular end-user group

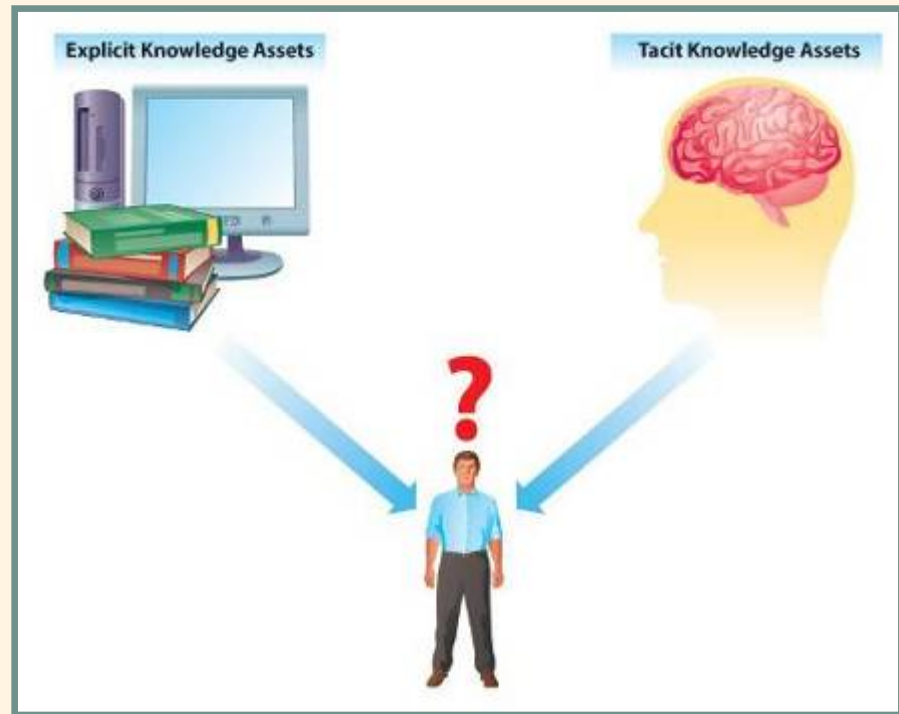


# Increasing Business Intelligence with Knowledge Management

- Knowledge management
  - The process used to get the greatest value from knowledge assets
- Knowledge management system
  - Collection of tools to generate, store, share, and manage tacit knowledge assets

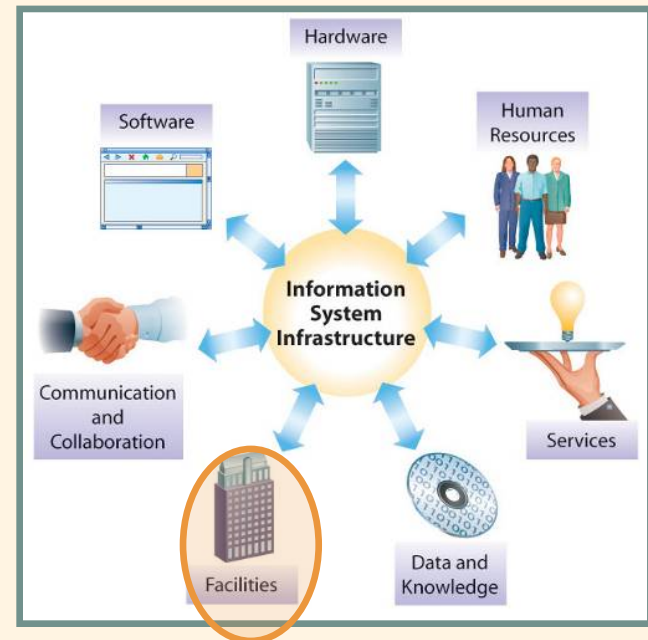
# Knowledge Assets

- Knowledge assets: skills, routines, practices, principles, formulas, methods, heuristics, and intuitions
  - Explicit knowledge assets
  - Tacit knowledge assets



# Managing the Facilities Infrastructure

- Ensuring availability
  - High availability facilities
  - Collocation facilities
- Securing the facilities
  - Physical safeguards



# Ensuring Availability

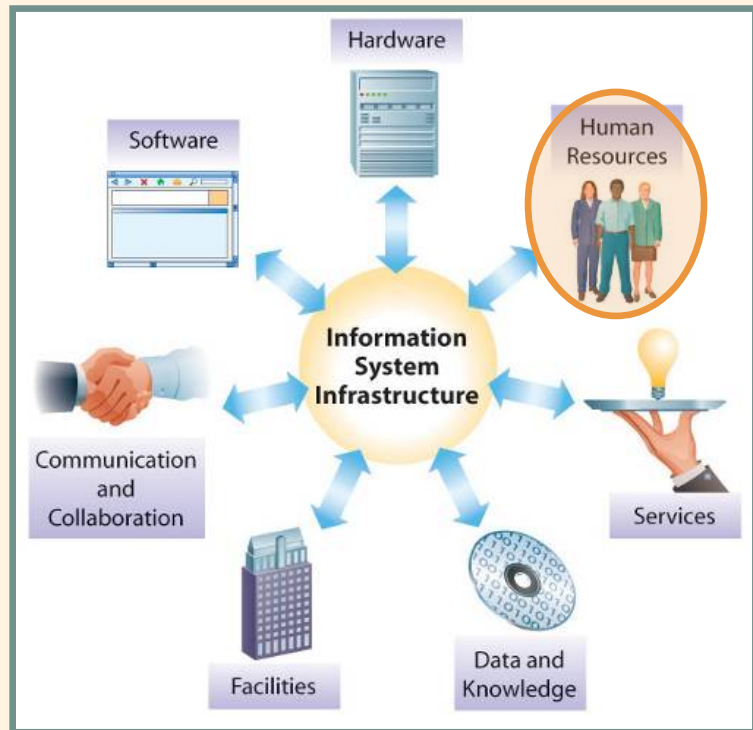
## High-availability facilities



## Collocation facilities

# Managing Human Resource Infrastructure

- Need for highly trained workforce may be managed by:
  - Facility location
  - Educational grants
  - Human resource policies
  - Outsourcing of human resource services

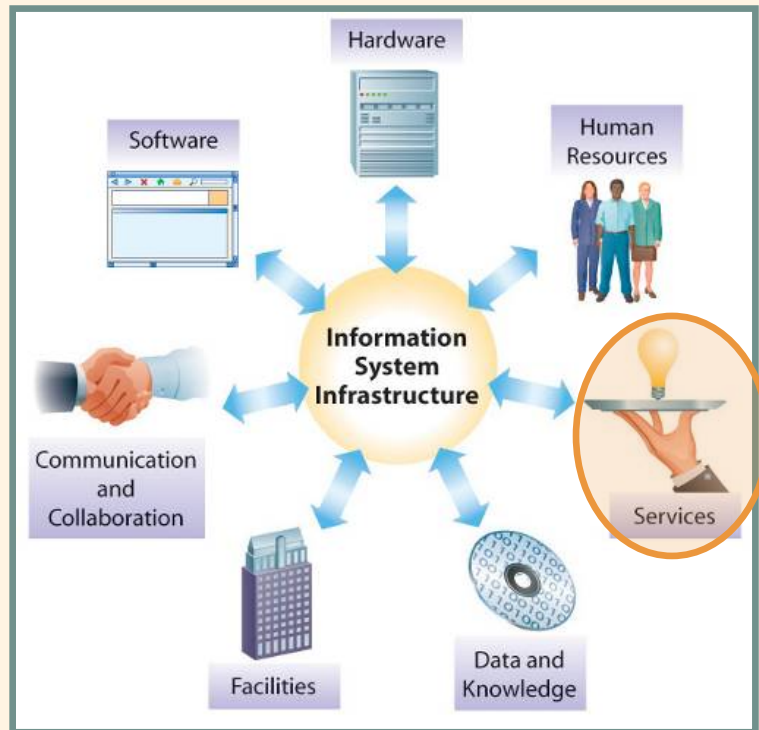


# Managing Human Resource Infrastructure

- Locating facilities in areas with high concentration of people with a certain skill
  - Silicon Valley, CA or Seattle, WA
- Providing education opportunities for existing employees
  - Educational grants
- Human resource policies
  - Flextime, telecommuting
- Outsourcing of human resource services
  - Bangalore, India

# Managing the Service Infrastructure

- Increased complexity of IS
  - Services providers address infrastructure needs
  - Outsourcing





# Services Providers Addressing Infrastructure Needs

IS Infrastructure Component	Service	Example
Hardware	Utility computing	Organizations pay for processing or data storage on an as-needed basis
Software	Application service provider (ASP)	Organizations use a payroll system hosted on an ASP's server
Communication and collaboration	Videoconferencing	Organizations install HP HALO rooms and pay a monthly fee for usage and support
Data and knowledge	ASP	Data from applications hosted on an ASP's server is stored by the provider
Facilities	Collocation facility	Companies rent space for their servers in a collocation facility

# Outsourcing

- Partial or entire responsibility for IS development and/or management given to an outside organization
  - Enables focus on core competencies
    - Outsourced functions
      - Non-core functions
      - E.g., accounting, human resources
    - Some business functions traditionally kept within the organization
      - Information systems security

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# Ensuring a Reliable and Secure Infrastructure

- Variety of threats to IS infrastructure
- Infrastructure reliability may be the most important concern
  - Disaster planning
  - Designing the recovery plan
  - IS controls, auditing and the Sarbanes-Oxley Act



# Disaster Planning

- Disaster recovery plan
  - Detailed list of procedures to follow when recovering from a systems-related disaster
- Backup Sites
  - Cold backup site – an empty warehouse with all necessary connections for power and communication
  - Hot backup site – a fully equipped backup facility
  - Choosing a backup site location
    - different geographic location to minimize the risk of a disaster happening to both systems

# Designing the Recovery Plan

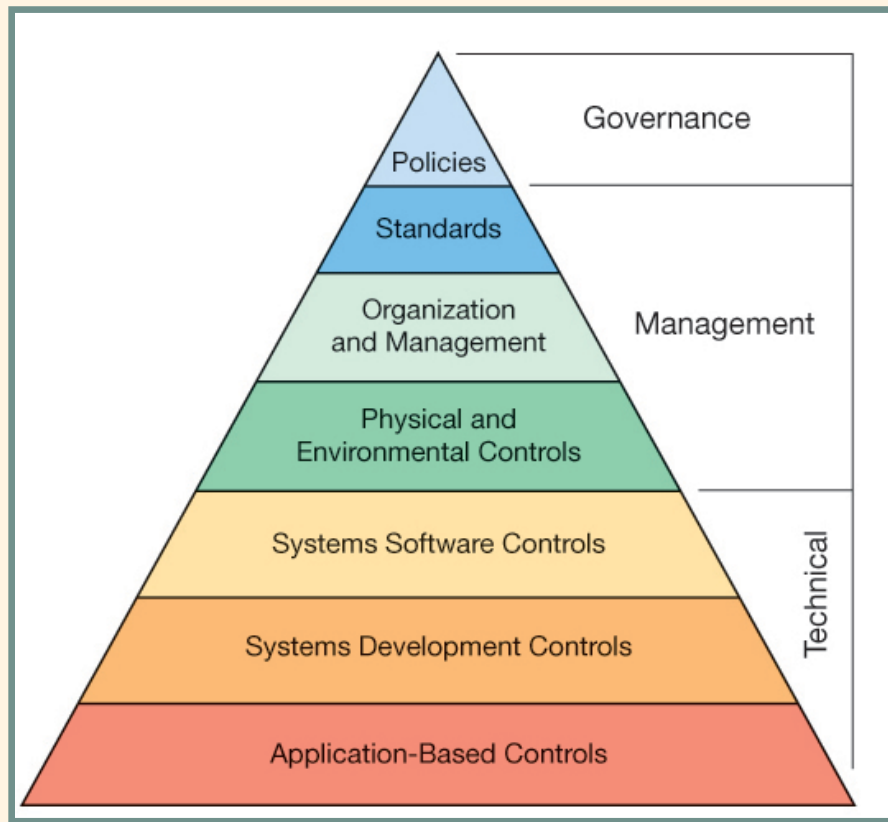
- Recovery time objectives
  - Specify the maximum time allowed to recover from a catastrophic event
- Recovery point objectives
  - Specify how current the backup data should be

# IS Controls, Auditing and Sarbanes-Oxley Act

- IS controls
  - Specific IT processes designed to ensure reliability of information
  - Controls should be a combination of three types of controls:
    - Preventive controls
    - Detective controls
    - Corrective controls



# Hierarchy of IS Controls



# IS Auditing

- IS audit
  - Performed by external auditors to help organizations assess the state of their IS controls
    - To determine necessary changes
    - To assure the IS availability, confidentiality, and integrity
- Risk assessment
  - Determine what type of risks the IS infrastructure faces
- Computer Assisted Auditing Tools (CAAT)
  - Specific software to test applications and data, test data, or simulations.

# The Sarbanes-Oxley Act

- Formed as a reaction to large-scale accounting scandals
  - WorldCom, Enron
- Primarily addresses the accounting side of organizations
- COBIT (Control Objectives for Information and Related Technology)
  - Set of best practices
    - Help organizations to maximize the benefits from their IS infrastructure
    - Establish appropriate controls

**End of Chapter Content**

# Opening Case: Managing in the Digital World: “I Googled You!”

- **January 1996** – Brin and Page create BackRub
- **September 1998** - Google Inc. began operations
  - PC Magazine named it best search engine of 1998
- **1999** - Google has 9 employees
  - more than 500,000 searches a day
- **2000** – world’s largest search engine
  - 18 million queries a day
- **April 2004** – Google’s first IPO
  - April 2004 - \$85
  - December 2006 - \$466





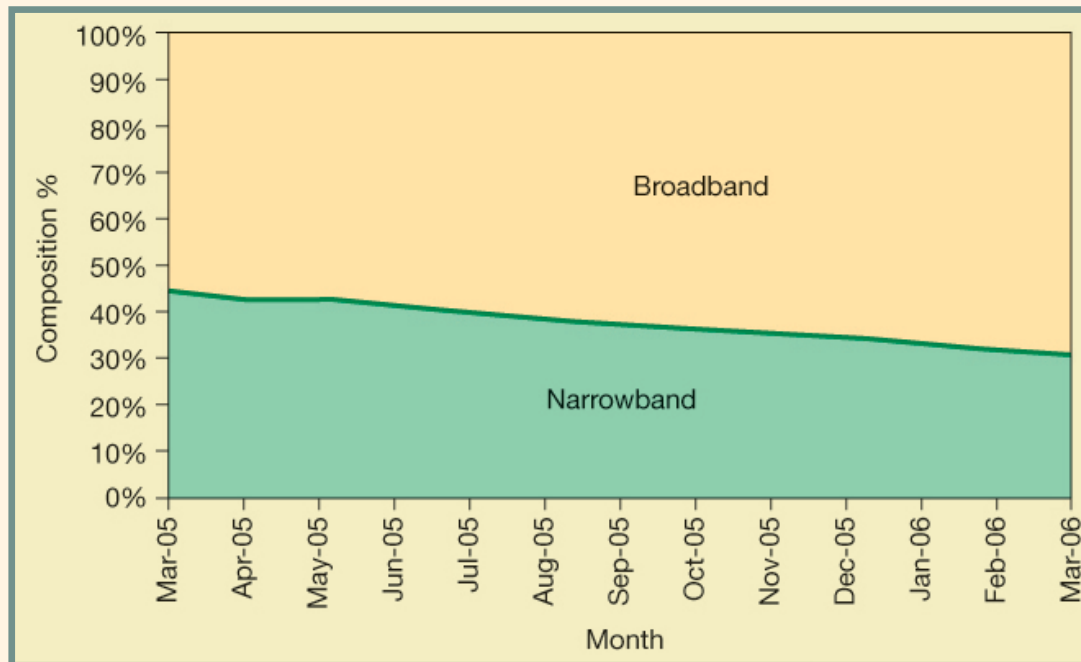
# Who Owns Company Data?

- Stealing information from a company is worse than stealing hardware
  - 2004 survey – 70% of respondents had stolen key information from an employer
    - 72% reported they had no ethical problems with stealing the information
    - 30% had stolen customer contact information
    - 80% justified their actions by saying they built the database in the first place



## Broadband Access Increases

- In 2006, nearly 70% of Internet users in the U.S. had access to broadband connections







# Cognitive Radio

- Wireless transmission very popular
- Overcrowding of airways a concern
  - Dropped calls
    - Wireless frequencies are full
    - Too few wireless towers
    - Environmental interference
- Solution - “Cognitive radio”
  - Detects unused portions of signal spectrum
  - Designed for emergency situations
  - Intel the leader in commercialization of the technology



# Larry Page and Sergey Brin, Cofounders of Google

- 1<sup>st</sup> quarter results as a public company: \$805.9 million
- Brin and Page are worth \$12.8 billion each
- Google.org – addresses world's most pressing problems
- Developed innovative ways to increase employee morale
  - Roller-hockey games
  - On-site workout and massage rooms
  - One day a week spent on innovation projects





# Toyota's Savvy CIO

- **Problem:**
  - IT failures due to misalignment between business and IT departments
- **Solution:**
  - Creation of cooperative planning process
  - Input from corporate headquarters
  - Changes in the IT department
- **Results:**
  - Deadlines met
  - 16% project cost reduction – saving millions of dollars



# BlackBerry

- Research in Motion (RIM) introduced BlackBerry in 1999
  - More than 3 million users in March 2006
- NTP Inc. sued RIM claiming patent infringement
  - NTP sent notice of their wireless communications patents to wireless companies (including RIM)
  - RIM agreed to pay NTP \$612.5 million



# Radio

- Satellite radio
  - Referred to as “jukebox on steroids”
  - Operates via signal received from low-orbiting satellites
  - Prominent players: XM Radio, Sirius, WorldSpace
  - Market share of traditional radio stations is decreasing